CLUTCH CONNECTION/DISCONNECTION DETECTION SYSTEM FOR SINGLE-CYLINDER ENGINE

BACKGROUND OF THE INVENITON

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority under 35 USC 119 to Japanese Patent Application No. 2002-207799 filed on July 17, 2002 the entire contents thereof are hereby incorporated by reference.

Field of the Invention

[0002] The present invention relates to a clutch connection/disconnection detection system for a single-cylinder engine, for detecting the connection/disconnection of a clutch intermediately provided between a crankshaft of the single-cylinder engine and a power transmission means for transmitting the output of the crankshaft.

Description of Background Art

[0003] Conventionally, in the case of detecting the connection/disconnection of a manual clutch, the connection/disconnection of the clutch has been detected by detecting the operation of a manual lever with a switch disposed in the vicinity of the manual switch, and in the case of a centrifugal clutch, the

connection/disconnection of the clutch has been decided by the rotational frequency of the crankshaft based on the characteristic of the clutch.

[0004] Meanwhile, information on the connection/disconnection of the clutch is needed in the case of, for example, performing an idling control of the engine. Since a low detection accuracy leads to a lowering of idling stability, it is required to detect the connection/disconnection of the clutch with high accuracy. However, the above-mentioned detection systems according to the prior art cannot be said to be capable of detecting the connection/disconnection of the clutch with high accuracy.

SUMMARY AND OBJECTS OF THE INVENTION

[0005] The present invention has been made in consideration of the above circumstances. Accordingly, it is an object of the present invention to provide a clutch connection/disconnection detection system for a single-cylinder engine by which the connection/disconnection of the clutch can be detected with high accuracy.

[0006] In order to attain the above object, the present invention provides a clutch connection/disconnection detection system for a single-cylinder engine, for detecting the connection/disconnection of a clutch intermediately provided between a crankshaft of the single-cylinder engine and a power transmission means for transmitting the output of the crankshaft, which includes a rotation variation coefficient detection means for detecting the rotation variation coefficient of the crankshaft, and a decision means for deciding the connection/disconnection of the clutch by comparing the rotation variation

coefficient detected by the rotation variation coefficient detection means with a preliminarily determined threshold.

[0007] Meanwhile, the angular moment of the crankshaft varies depending on the connection/disconnection of the clutch, and the rotation variation coefficient of the crankshaft also varies with the varying angular moment. Therefore, when the connection/disconnection of the clutch is decided based on the rotation variation coefficient of the crankshaft by the above constitution according to the present invention, the connection/disconnection of the clutch can be detected accurately without need for a special switch or sensor.

[0008] In the present invention the threshold is preliminarily set according to engine speed. With this constitution, the connection/disconnection of the clutch can be detected accurately in the manner of being adapted to variations in the operating condition of the engine.

[0009] Further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[00010] The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings which are

given by way of illustration only, and thus are not limitative of the present invention, and wherein:

[00011] Fig. 1 is a schematic diagram showing a part of a power transmission system of a single-cylinder engine;

[00012] Fig. 2 is a sectional view taken along line 2-2 of Fig. 1;

[00013] Figs. 3(a) and 3(b) are diagrams showing an output signal from a pulser; and

[00014] Fig. 4 is a diagram showing a table of threshold.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[00015] Now, a mode for carrying out the present invention will be described below based on an embodiment of the invention shown in the accompanying drawings.

[00016] First, in Fig. 1, a four-cycle single-cylinder engine 5 mounted, for example, on a motorcycle or the like includes a single piston 6, which is connected to a crankshaft 7 through a connecting rod 8. One end of the crankshaft 7 is connected, through a centrifugal clutch 11, to a drive pulley 10 of a belt-type continuously variable transmission 9 serving as a power transmission means for transmitting the power of the crankshaft 7 to the side of rear wheels (not shown) while changing the speed. In addition, an AC generator 12 or the like is connected to the other end of the crankshaft 7.

[00017] Referring to Fig. 2 also, a circular rotating disk 13 provided on its outer circumference with a plurality of, for example, nine projections 13a... is coaxially attached to the crankshaft 7, and a pulser 14 for detecting each of the projections

13a... and outputting a pulse signal for each time a projection is detected is fixedly disposed so as to face the outer circumference of the rotating disk 13.

[00018] According to the rotation of the crankshaft 7 and the rotating disk 13, the pulser 14 outputs the pulse signals as shown in Fig. 3(a). When numerals 0 to 17 are assigned to stages between the pulse signals during two revolutions of the crankshaft 7 as shown in Fig. 3(b), stages 4 to 6 correspond to the combustion stroke, stages 7 to 12 correspond to the exhaust stroke, stages 13 to 15 correspond to the intake stroke, and stages 16 to 3 correspond to the compression stroke. Times TSN4, TSH4, TSK4, and TSA4 of the combustion, exhaust, intake, and compression strokes during two revolutions of the crankshaft 7 in a time ME4U can be obtained by integrating the times of the stages for each of the strokes.

[00019] The output signal from the pulser 14 is inputted to an electronic control unit 15 for controlling the operation of the engine 5. The electronic control unit 15 has the function of detecting the connection/disconnection of the centrifugal clutch 11, and the part for detecting the connection/disconnection of the centrifugal clutch 11 includes a rotation variation coefficient detection means 16 for detecting the rotation variation coefficient of the crankshaft 7, and a decision means 17 for deciding the connection/disconnection of the centrifugal clutch 11 by comparing the rotation variation coefficient detected by the rotation variation coefficient detection means 16 with a preliminarily determined threshold.

[00020] In the rotation variation coefficient detection means 16, for example, the rotation variation coefficient TSRAT is calculated according to the following arithmetic formula by use of the time TSH4 of the exhaust stroke, the time TSA4 of the compression stroke, and the time ME4U required for two revolutions of the

crankshaft 7.

[00021] TSRAT = (TSA4 - TSH4)/ME4U

[00022] The decision means 17 decides the connection/disconnection of the centrifugal clutch 11 by use of the table of the threshold TSRATS shown in Fig. 4. The threshold TSRATS is preliminarily determined so as to vary according to the engine speed Ne.

[00023] Meanwhile, the angular moment of the crankshaft 7 varies depending on the connection/disconnection of the centrifugal clutch 11, and the rotation variation coefficient TSRAT of the crankshaft 7 varies with the varying angular moment. Specifically, the rotation variation coefficient TSRAT of the crankshaft 7 is small when the centrifugal clutch 11 is in the connected condition, whereas the rotation variation coefficient TSRAT of the crankshaft 7 is greater when the centrifugal clutch 11 is in the disconnected condition. When the rotation variation coefficient TSRAT obtained by the rotation variation coefficient detection means 16 is not less than the threshold TSRATS shown in Fig. 4, the decision means 17 decides that the centrifugal clutch 11 is in the disconnected condition; when the rotation variation coefficient TSRAT obtained by the rotation variation coefficient detection means 16 is less than the threshold TSRATS shown in Fig. 4, the decision means 17 decides that the centrifugal clutch 11 is in the connected condition.

[00024] By deciding the connection/disconnection of the centrifugal clutch 11 based on the rotation variation coefficient TSRAT of the crankshaft 7, and by utilizing the fact that the angular moment of the crankshaft 7 varies depending on the connection/disconnection of the centrifugal clutch 11, as above-described, the

connection/disconnection of the centrifugal clutch 11 can be detected with a high accuracy, without the need for a special switch or sensor.

[00025] Moreover, since the threshold TSRATS for deciding the connection/disconnection of the centrifugal clutch 11 is preliminarily determined according to the engine speed Ne, the connection/disconnection of the centrifugal clutch 11 can be detected accurately in the manner of being adapted to variations in the operating condition of the engine.

[00026] While the embodiment of the present invention has been described above, the invention is not limited to the above embodiment, and various design modifications are possible without departing from the invention as defined in the claims.

[00027] For example, while description has been made of the centrifugal clutch 11 in the above embodiment, the present invention is widely applicable to as a system for detecting the connection/disconnection of a clutch intermediately provided between the crankshaft 7 of the single-cylinder engine 5 and the power transmission means 9 for transmitting the output of the crankshaft 7.

[00028] As described above, according to the present invention, the connection/disconnection of the clutch is decided based on the rotation variation coefficient of the crankshaft, whereby the connection/disconnection of the clutch can be detected accurately, without need for a special switch or sensor.

[00029] In addition, according to the present invention, the connection/disconnection of the clutch can be detected accurately in the manner of being adapted to variations in the operating condition of the engine.

[00030] The invention being thus described, it will be obvious that the same

may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.